

Chapter # 1

The Science of Biology

1. Which branch of Biology focuses on the study of the structure and function of cells?

Options:

- a) Cytology ✓
- b) Mycology
- c) Histology
- d) Ecology

Explanation:

Cytology is the study of cells—their structure, function, and importance in life processes. It helps us understand the basic building blocks of life.

2. The study of the processes of heredity and variation in living organisms is known as:

Options:

- a) Ecology
- b) Genetics ✓
- c) Anatomy
- d) Embryology

Explanation:

Genetics deals with how traits are passed from parents to offspring and explains the concepts of genes, DNA, mutations, and hereditary diseases.

3. Insulin made through bacteria is an example of the technique of:

Options:

- a) Parasitology
- b) Biotechnology ✓
- c) Biochemistry
- d) Histology

Explanation:

Biotechnology uses living organisms (like bacteria) for the benefit of humans—such as producing insulin through genetic engineering.

4. Heart pumps blood, stomach digests food, and kidneys excrete wastes. The statement comes from:

Options:

- a) Physiology ✓
- b) Anatomy
- c) Morphology
- d) Histology

Explanation:

Physiology explains how different body parts and organs function and work together to maintain life in an organism.

5. Which branch of Biology involves the study of the classification of organisms?

Options:

- a) Taxonomy ✓
- b) Physiology
- c) Palaeontology
- d) Biogeography

Explanation:

Taxonomy is the science of identifying, naming, and classifying organisms into groups like kingdom, phylum, class, etc.

6. Which step comes between making hypothesis and doing experiments?

Options:

- a) Making deductions ✓
- b) Making observations
- c) Summarizing results
- d) Analyzing data

Explanation:

After creating a hypothesis, scientists make *deductions* (logical predictions) which are then tested through experiments.

7. Which of the following is NOT a characteristic of the scientific method?

Options:

- a) It relies on evidence
- b) It involves formulating hypotheses
- ✓ c) Hypothesis will always be correct
- d) It requires rigorous testing

Explanation:

Scientific method relies on testing and evidence, but hypotheses are not always correct. They can be proven wrong through experimentation.

8. Choose the correct sequence of steps of scientific method:**Options:**

- ✓ a) Observations → Hypothesis → Deduction → Experiments
- b) Observations → Hypothesis → Law → Theory
- c) Hypothesis → Observations → Deduction → Experiments
- d) Law → Theory → Deduction → Observations

Explanation:

The correct sequence starts with observing a problem, making a hypothesis, drawing logical deductions, and then performing experiments to test them.

9. People who slept near smoky fire had less chance to suffer from malaria. Why?**Options:**

- a) Smoke kills Plasmodium in their blood
- b) Fire increases temperature and Plasmodium are killed in air
- ✓ c) Mosquitoes cannot tolerate smoke and are repelled
- d) Smoke kills Plasmodium present in mosquitoes

Explanation:

Mosquitoes are repelled by smoke, so they don't bite people sleeping near fire, reducing the chance of getting malaria.

10. Experiments are very important in the scientific method because a researcher:

Options:

- a) Always gets correct results
- ✓ b) Disproves many hypotheses and gets some hypothesis proved
- c) Is sure that he will prove hypotheses
- d) Gets a chance to sit in the laboratory

Explanation:

Experiments help test different hypotheses. Some are proven wrong while others may be proven correct, helping us reach conclusions.

B. Write short answers:

1. Define the following branches of Biology:

- **Genetics:** The branch of biology that deals with heredity and variation of organisms.
 - **Taxonomy:** The science of classifying organisms based on characteristics and relationships.
 - **Palaeontology:** The study of fossils and ancient forms of life.
 - **Marine Biology:** The study of life in oceans and other saltwater environments.
 - **Pathology:** The study of diseases — their causes, development, and effects on the body.
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2. Which branch of Biology involves the study of the development of organisms from fertilization to birth or hatching?

Answer: *Embryology* is the branch that studies development of organisms from zygote to complete structure (birth or hatching).

3. How is the profession of medicine and surgery different from animal husbandry?

Answer:

- *Medicine and surgery* deal with diagnosing and treating diseases in humans.
 - *Animal husbandry* focuses on breeding, care, and management of farm animals to increase production.
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4. Differentiate between Morphology and Physiology:

Morphology	Physiology
Study of structure and form of organisms	Study of functions and processes in living organisms

5. What is Computational Biology?

Answer:

Computational Biology is a branch of biology that uses computer simulations, mathematical models, and algorithms to study biological systems and relationships.

6. What is the role of observation and experimentation in the scientific method?

Answer:

- *Observation* helps identify a problem and gather data.
- *Experimentation* is used to test hypotheses and confirm or reject scientific explanations.

[Descriptive Questions – Detailed Answers](#)

1. Link the study of Biology with that of Physics, Chemistry, Statistics, Geography, Economics, and Computer Science.

Answer:

Biology is not an isolated subject; it is deeply linked with various other sciences that help understand living systems better:

- **Physics:**
 - Physics explains energy, forces, and motion, which are important in biological systems.
 - Example: Blood flow in arteries, sound vibrations in the ear, and light behavior in the eye.
 - Principles like thermodynamics help understand metabolism and body temperature regulation.
- **Chemistry:**
 - Life depends on chemical reactions like respiration, digestion, and photosynthesis.
 - Study of biomolecules like carbohydrates, proteins, enzymes, and hormones is crucial in biology.
 - It helps understand molecular biology and genetic engineering.

- **Statistics:**
 - Statistics is essential for analyzing experimental data and biological research results.
 - It helps in calculating averages, probabilities, and drawing graphs in fields like genetics, ecology, and medicine.
 - **Geography:**
 - Geography supports ecological studies, biodiversity distribution, and environmental impacts on organisms.
 - Helps in studying population patterns, migration, habitat types, and climate influence on life.
 - **Economics:**
 - Biology helps improve agricultural production, forestry, fisheries, and healthcare, all of which impact the economy.
 - Economics evaluates the cost and benefit of biological technologies like GMOs and vaccines.
 - **Computer Science:**
 - Computers are used in bioinformatics, genetic data analysis, and disease modeling.
 - Example: DNA sequencing, protein structure prediction, and managing big biological databases.
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2. Explain how the study of Biology can lead to different professional studies.

Answer:

Biology is the foundation of many applied and professional fields. A student of biology can pursue the following careers:

- **Medicine and Surgery:**
 - Study of human anatomy, physiology, and diseases leads to becoming a doctor or surgeon.
 - Involves diagnosis, treatment, and prevention of diseases.
- **Pharmacy:**
 - Focuses on the development and use of medicines.
 - Pharmacists study drug action, dosage, and safety.
- **Veterinary Science:**
 - Concerned with animal health, treatment, and surgery.
 - Includes livestock care, pet medicine, and zoonotic disease prevention.
- **Agriculture and Agronomy:**
 - Involves study of crop production, soil science, and pest control.
 - Aims to increase food production through improved methods.
- **Microbiology:**
 - Study of microorganisms like bacteria, viruses, and fungi.
 - Used in making antibiotics, fermentation, and vaccine development.
- **Biotechnology:**

- Uses living organisms to produce useful products (e.g., insulin, vaccines).
 - Includes genetic engineering and tissue culture.
 - **Forestry and Fisheries:**
 - Focuses on managing forests and aquatic resources.
 - Helps in conservation and sustainable development.
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3. Science is a collaborative field in which scientists work together to share knowledge. Prove this statement by giving examples.

Answer:

Scientific progress is a team effort. Scientists around the world collaborate and share findings to achieve results faster and more effectively. Examples:

- **Human Genome Project:**
 - A global collaboration where scientists from 20+ countries worked for over a decade to decode the entire human DNA.
 - It led to breakthroughs in genetics, medicine, and bioinformatics.
 - **Covid-19 Vaccine Development:**
 - Researchers from different countries shared virus genome data, research techniques, and clinical trial results.
 - As a result, vaccines were developed in less than a year.
 - **Discovery of DNA Structure:**
 - James Watson and Francis Crick built on the X-ray diffraction data from Rosalind Franklin.
 - This teamwork led to the discovery of the double-helix model of DNA.
 - **CERN and the Large Hadron Collider:**
 - Thousands of physicists and biologists globally collaborate at CERN to study the fundamental particles of life.
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4. How is a hypothesis converted to theory, law, and principle?

Answer:

- **Hypothesis:**
 - A hypothesis is a testable explanation of an observation or a scientific question.
 - It is not yet proven but can be tested through experiments.
- **Theory:**
 - When a hypothesis is tested repeatedly through experiments and supported by evidence, it becomes a theory.
 - Example: Germ Theory of Disease.
- **Law:**

- A theory that is universally accepted and proven to be true under all conditions becomes a scientific law.
 - Example: Mendel's Law of Inheritance.
 - **Principle:**
 - A scientific principle is a well-accepted law or concept that explains natural phenomena.
 - Example: Principle of Natural Selection.
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5. What are the basic steps a scientist adopts in order to solve a scientific problem?

Answer:

A scientist uses a methodical approach to solve problems. The steps are:

1. **Observation:**
 - Careful noticing of natural phenomena.
 2. **Question/Problem Identification:**
 - Defining what needs to be explained or solved.
 3. **Hypothesis Formation:**
 - Proposing a tentative explanation or solution.
 4. **Deduction:**
 - Making predictions based on the hypothesis.
 5. **Experimentation:**
 - Testing the hypothesis with controlled experiments.
 6. **Conclusion:**
 - Analyzing results to confirm or reject the hypothesis.
 7. **Reporting Results:**
 - Sharing findings with the scientific community through reports or journals.
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6. Describe the work of different scientists in discovering the cause of malaria.

Answer:

- **Alphonse Laveran (1880):**
 - A French scientist who first observed *Plasmodium* (malaria parasite) in the blood of patients.
 - He proposed that the disease is caused by this parasite.
- **Ronald Ross (1897):**
 - A British doctor working in India.
 - He allowed mosquitoes to bite infected birds, then dissected them and found *Plasmodium* in the stomach of mosquitoes.
 - Proved that mosquitoes transmit malaria.

- **Giovanni Grassi (1898):**
 - Identified specific species of *Anopheles* mosquitoes responsible for transmission.
 - His work helped target control strategies.
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7. Write a descriptive note on the experiments performed by Ross.

Answer:

- Sir **Ronald Ross** conducted his groundbreaking experiments in India.
 - He studied malaria in birds and suspected that mosquitoes played a role.
 - He allowed mosquitoes to bite malaria-infected birds. After a few days, he dissected the mosquitoes.
 - He found the *Plasmodium* parasite in their stomach walls.
 - This proved that mosquitoes are the **vectors** (carriers) of malaria.
 - His discovery earned him a Nobel Prize in Medicine and revolutionized the understanding of disease transmission.
 - Ross's work led to public health policies like mosquito control to prevent malaria.
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D. Inquisitive Questions:

1. Why is it important to classify biology into different branches such as botany, zoology, and microbiology? How does specialization benefit scientific research?

Answer:

Biology is vast; classification into branches like:

- **Botany (plants)**
- **Zoology (animals)**
- **Microbiology (microorganisms)**

...helps researchers specialize. Specialization leads to:

- In-depth understanding
 - Faster discovery
 - Better use of tools and technologies
 - Division of work in collaborative research
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2. How can a scientist apply the growth method to confirm an observation that a certain plant species grows more quickly in shady places than in direct sunlight?

Answer:

The scientist would follow these steps:

1. **Observation:** Some plants grow better in shade.
2. **Hypothesis:** The plant grows faster in shade.
3. **Deduction:** If true, shaded plants will show more height/leaf area.
4. **Experimentation:** Grow same species in both conditions.
5. **Recording data:** Measure growth after a set time.
6. **Conclusion:** Analyze data to accept or reject hypothesis.

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